

## ABSTRACT

This need is met by the present invention wherein structural stress in a fatigue-prone region of a structure is determined by using the nodal forces and displacement values in the fatigue-prone region, or equilibrium-equivalent simple stress states consistent with elementary structural mechanics in the fatigue-prone region. The determination is substantially independent of mesh size and is particularly well-suited for applications where  $S$ - $N$  curves are used in weld fatigue design and evaluation, where  $S$  represents nominal stress or stress range and  $N$  represents the number of cycles to failure. The present invention is directed to structural stress analysis through various combinations of modeling, calculation, and direct measurement schemes.